

USSN: 10/720,558
Atty. Docket No.: 2003B124
Amdt. dated March 30, 2005
Reply to Office Action of November 30, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (Original): A catalyst composition comprising at least two metal components selected from Groups 8 to 10 of the Periodic Table of Elements and at least one metal component selected from Group 13 of the Periodic Table of Elements.

Claim 2 (Original): The catalyst composition of claim 1 wherein one of said at least two metal components selected from Groups 8 to 10 of the Periodic Table of Elements is rhodium.

Claim 3 (Original): The catalyst composition of claim 2 wherein another of said at least two metal components is selected from iron, ruthenium and cobalt.

Claim 4 (Original): The catalyst composition of claim 1 wherein said at least one metal component selected from Group 13 of the Periodic Table of Elements is indium.

Claim 5 (Original): The catalyst composition of claim 1 and further including a binder and/or support.

Claim 6 (Original): A catalyst composition comprising:

- (a) a first component comprising rhodium;
- (b) a second component comprising at least one metal selected from Group 13 of the Periodic Table of Elements; and
- (c) a third component comprising at least one metal different from said first and second components and selected from Groups 1 to 15 of the Periodic Table of Elements.

Claim 7 (Original): The catalyst composition of claim 6 and further including a support.

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Claim 8 (Original): The catalyst composition of claim 7 and comprising from about 0.01 wt% to about 10 wt% of the first component, based on the rhodium metal present by weight of the total weight of the catalyst including the support.

Claim 9 (Original): The catalyst composition of claim 7 and comprising from about 0.04 wt% to about 5 wt% of the first component, based on the rhodium metal present by weight of the total weight of the catalyst including the support.

Claim 10 (Original): The catalyst composition of claim 7 and comprising from about 0.01 wt% to about 30 wt% of the second component, based on the amount of said Group 13 metal present by weight of the total weight of the catalyst including the support.

Claim 11 (Original): The catalyst composition of claim 7 and comprising from about 0.04 wt% to about 20 wt% of the second component, based on the amount of said Group 13 metal present by weight of the total weight of the catalyst including the support.

Claim 12 (Original): The catalyst composition of claim 7 wherein said second component comprises indium.

Claim 13 (Original): The catalyst composition of claim 12 and comprising from about 0.01 wt% to about 20 wt% of the second component, based on the amount of indium metal present by weight of the total weight of the catalyst including the support.

Claim 14 (Original): The catalyst composition of claim 11 and comprising from about 0.04 wt% to about 10 wt% of the second component, based on the amount of indium metal present by weight of the total weight of the catalyst including the support.

Claim 15 (Original): The catalyst composition of claim 7 and comprising from about 0.01 wt% to about 50 wt% of the third component, based on the amount of metal of said third component

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present by weight of the total weight of the catalyst including the support.

Claim 16 (Original): The catalyst composition of claim 7 and comprising from about 0.05 wt% to about 30 wt% of the third component, based on the amount of metal of said third component present by weight of the total weight of the catalyst including the support.

Claim 17 (Original): The catalyst composition of claim 6 wherein said third component comprises at least one metal selected from Groups 8 to 10 of the Periodic Table of Elements.

Claim 18 (Original): The catalyst composition of claim 6 wherein said third component is selected from iron, ruthenium and cobalt.

Claim 19 (Original): The catalyst composition of claim 7 wherein the third component is iron and the catalyst composition comprises from about 0.05 wt% to about 30 wt% of the third component, based on the amount of iron metal present by weight of the total weight of the catalyst including the support.

Claim 20 (Original): The catalyst composition of claim 7 wherein the third component is iron and the catalyst composition comprises from about 0.1 wt% to about 20 wt% of the third component, based on the amount of iron metal present by weight of the total weight of the catalyst including the support.

Claim 21 (Original): The catalyst composition of claim 7 wherein the third component is cobalt and the catalyst composition comprises from about 0.05 wt% to about 30 wt% of the third component, based on the amount of cobalt metal present by weight of the total weight of the catalyst including the support.

Claim 22 (Original): The catalyst composition of claim 7 wherein the third component is cobalt and the catalyst composition comprises from about 0.1 wt% to about 25 wt% of the third

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component, based on the amount of cobalt metal present by weight of the total weight of the catalyst including the support.

Claim 23 (Original): The catalyst composition of claim 7 wherein the third component is ruthenium and the catalyst composition comprises from about 0.05 wt% to about 10 wt% of the third component, based on the amount of ruthenium metal present by weight of the total weight of the catalyst including the support.

Claim 24 (Original): The catalyst composition of claim 7 wherein the third component is ruthenium and the catalyst composition comprises from about 0.1 wt% to about 5 wt% of the third component, based on the amount of ruthenium metal present by weight of the total weight of the catalyst including the support.

Claim 25 (Original): A catalyst composition comprising:

- (a) a first component comprising rhodium;
- (b) a second component comprising indium; and
- (c) a third component selected from one or more of iron, ruthenium and cobalt.

Claim 26 (Original): The catalyst composition of claim 25 and further including a support.

Claim 27 (Original): The catalyst composition of claim 26 and comprising from about 0.01 wt% to about 10 wt% of the first component, based on the rhodium metal present by weight of the total weight of the catalyst including the support.

Claim 28 (Original): The catalyst composition of claim 26 and comprising from about 0.04 wt% to about 5 wt% of the first component, based on the rhodium metal present by weight of the total weight of the catalyst including the support.

Claim 29 (Original): The catalyst composition of claim 26 and comprising from about 0.01 wt%

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to about 20 wt% of the second component, based on the indium metal present by weight of the total weight of the catalyst including the support.

Claim 30 (Original): The catalyst composition of claim 26 and comprising from about 0.04 wt% to about 10 wt% of the second component, based on the indium metal present by weight of the total weight of the catalyst including the support.

Claim 31 (Original): The catalyst composition of claim 26 wherein the third component is iron and the catalyst composition comprises from about 0.05 wt% to about 30 wt% of the third component, based on the amount of iron metal present by weight of the total weight of the catalyst including the support.

Claim 32 (Original): The catalyst composition of claim 26 wherein the third component is iron and the catalyst composition comprises from about 0.1 wt% to about 20 wt% of the third component, based on the amount of iron metal present by weight of the total weight of the catalyst including the support.

Claim 33 (Original): The catalyst composition of claim 26 wherein the third component is cobalt and the catalyst composition comprises from about 0.05 wt% to about 30 wt% of the third component, based on the amount of cobalt metal present by weight of the total weight of the catalyst including the support.

Claim 34 (Original): The catalyst composition of claim 26 wherein the third component is cobalt and the catalyst composition comprises from about 0.1 wt% to about 25 wt% of the third component, based on the amount of cobalt metal present by weight of the total weight of the catalyst including the support.

Claim 35 (Original): The catalyst composition of claim 26 wherein the third component is ruthenium and the catalyst composition comprises from about 0.05 wt% to about 10 wt% of the

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third component, based on the amount of ruthenium metal present by weight of the total weight of the catalyst including the support.

Claim 36 (Original): The catalyst composition of claim 26 wherein the third component is ruthenium and the catalyst composition comprises from about 0.1 wt% to about 5 wt% of the third component, based on the amount of ruthenium metal present by weight of the total weight of the catalyst including the support.

Claim 37 (Original): The catalyst composition of claim 25 wherein the molar ratio of rhodium to indium is from about 0.1 to about 1.2.

Claim 38 (Original): The catalyst composition of claim 25 wherein the molar ratio of rhodium to indium is from about 0.3 to about 0.9.

Claim 39 (Original): The catalyst composition of claim 25 wherein the molar ratio of rhodium to the metal of the third component is from about 0.001 to about 0.6.

Claim 40 (Original): The catalyst composition of claim 25 wherein the molar ratio of rhodium to the metal of the third component is from about 0.002 to about 0.3.

Claim 41 (Original): The catalyst composition of claim 26 wherein the support is selected from zirconia, alumina and ceria-alumina.

Claim 42 (Original): A method of making a catalyst composition, the method comprising:

- (a) applying a rhodium compound to a support;
- (b) applying a compound of a metal selected from Group 13 of the Periodic Table of Elements to the support; and
- (c) applying a compound of a further metal different from rhodium and from said Group 13 metal and selected from Groups 1 to 15 of the Periodic Table of Elements to the support.

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Claim 43 (Original): The method of claim 42 wherein said further metal compound is applied to the support before either the rhodium compound or the Group 13 metal compound.

Claim 44 (Original): The method of claim 42 wherein the rhodium compound and the Group 13 metal compound are applied to the support concurrently.

Claim 45 (Original): The method of claim 42 wherein the Group 13 metal compound is applied to the support before the rhodium compound.

Claim 46 (Original): The method of claim 42 wherein the rhodium compound is rhodium nitrate.

Claim 47 (Original): The method of claim 42 wherein the Group 13 metal compound is an indium compound.

Claim 48 (Original): The method of claim 47 wherein the indium compound is indium nitrate or indium formate.

Claim 49 (Original): The method of claim 42 wherein the further metal compound is selected from iron, cobalt and ruthenium compounds.

Claim 50 (Original): The method of claim 42 wherein at least one of the compounds is applied to the support by impregnating the support with a solution of the compound.

Claim 51 (Original): The method of claim 42 wherein at least one of the compounds is applied to the support by precipitating the compound from a solution containing ions of the associated metal.

Claim 52 (Original): The method of claim 42 and, after (a) and/or (b) and/or (c), calcining the support at a temperature of about 100°C to about 600°C.

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Claim 53 (Original): The method of claim 42 and, after (a), (b) and (c), treating the calcined support in a reducing atmosphere at a temperature in excess of 200°C.

Claim 54 (Withdrawn): A process for selectively removing alkynes or diolefins from a feedstock also containing olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition made by the method of claim 42.

Claim 55 (Withdrawn): A process for selectively removing alkynes or diolefins from a feedstock also containing olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition comprising at least two different metal components selected from Groups 8 to 10 of the Periodic Table of Elements and at least one metal component selected from Group 13 of the Periodic Table of Elements.

Claim 56 (Withdrawn): The process of claim 55 wherein the alkynes or diolefins have 2 to 4 carbon atoms and the feedstock also contains C₂ to C₄ olefins.

Claim 57 (Withdrawn): A process for selectively removing C₂ to C₄ alkynes or diolefins from a feedstock also containing C₂ to C₄ olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition comprising at least two different metal components selected from Groups 8 to 10 of the Periodic Table of Elements and at least one metal component selected from Group 13 of the Periodic Table of Elements, and the process producing an olefin-enriched product stream containing less than 20 weight % oligomerized alkyne and diolefin compounds, based on the weight of said oligomerized alkyne and diolefin compounds in said product stream by the weight of said feedstock.

Claim 58 (Withdrawn): The process of claim 57 and producing an olefin-enriched product stream containing less than 10 weight % oligomerized alkyne and diolefin compounds, based on the weight of said oligomerized alkyne and diolefin compounds in said product stream by the weight of said feedstock.

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Claim 59 (Withdrawn): A process for selectively removing alkynes or diolefins from a feedstock also containing olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition comprising

- (a) a first component comprising rhodium;
- (b) a second component comprising indium; and
- (c) a third component selected from one or more of iron, ruthenium and cobalt.

Claim 60 (Withdrawn): The process of claim 59 wherein the alkynes or diolefins have 2 to 4 carbon atoms and the feedstock also contains C₂ to C₄ olefins.

Claim 61 (Withdrawn): The process of claim 59 wherein said contacting is conducted at a temperature of from about 20°C to about 150°C, a pressure of from about 690 kPa to 4100 kPa, and a molar ratio of hydrogen to alkynes and diolefins of from about 1 to about 1000.

Claim 62 (Withdrawn): The process of claim 59 wherein said contacting is conducted at a temperature of from about 30°C to about 100°C, a pressure of from about 1400 kPa to 3400 kPa, and a molar ratio of hydrogen to alkynes and diolefins of from about 1.1 to about 800.